ECE457 –Parallel and Cluster Computing
Term – Spring 2019 (201901)

Instructor	**Office Hours**
Dr. Nikitas Dimopoulos	**Days:** **MR**
Phone: (250) 721-8902	**Time:** **16:00-16:30**
E-mail: nikitas@ece.uvic.ca	**Location:** **EOW 437**

I can be reached via email (please use "ECE457 question" as your subject)

If you need to see me in person at a different time, please make an appointment (via email).

If you need to see me urgently, please come to my office.

Course Objectives

The focus of the course is to explore the programming practices for clusters (and High Performance Computers).
This will be accomplished through the use of the two prevailing standard environments i.e. MPI (Message Passing Interface) and OpenMP. We will study fundamental algorithms and their parallel implementations.
You will be gaining hands-on experience on a cluster environment (4-node/32-core Intel Xeon X5520 system)

Learning Outcomes

The student will be able to
- Describe the domain of High Performance Computers including shared memory, distributed memory, pipelining, clusters, many-core and non-homogeneous systems.
- Describe the use of HPC in solving problems that are societally relevant.
- Explain the interplay of communications and computation in an HPC environment.
- Evaluate the latency and throughput of a communications link.
- Describe collective communications.
- Analyze the performance of an application running on a parallel system and choose the appropriate scaling.
- Use collective communication primitives in a parallel algorithm.
- Design parallel algorithms using domain or functional decomposition.
- Use MPI or OpenMP to implement a parallel algorithm.
- Describe the architecture and use of GPUs.
- Describe the parallel implementation of a number of important algorithms including N-body problem, Matrix-Vector multiplication, Monte-Carlo methods etc.
- Evaluate the performance of the implemented algorithm through speedup and scaling studies.

Syllabus

- Preliminaries. The space of high performance computers
- Clusters. Commodity nodes and interconnection network strategies. Why performance depends on interconnections
- Programming. MPI and OpenMP. Develop programming skills through a number of applications.
- Partition, data decomposition, communication, granularity.

- The Sieve of Eratosthenes (finding prime numbers)
- The shortest-path problem
- Linear algebra (matrix-vector, matrix-matrix multiplication, linear systems)
- Monte Carlo Methods
- Finite Difference Methods

LECTURES   **LAB**

A-Section(s): A01 / CRN 20898
Days: MR
Time: 14:30-15:50
Location: CLE A308

Required Text	**Optional Text**
Title: Parallel Programming in C and OpenMP	Title:
Author: M. J. Quinn	Author:
Publisher: McGraw Hill	Publisher:
Year: 2004	Year:

Course web site: http:www.ece.uvic.ca/~ece457
Login: 457553

References:

Assessment:

Assignments:	5%	
Project	5% (bonus)	
Midterm	40%	**Thursday, February 7, 2019**
Final	55%	

<u>Note</u>**:**
- Failure to pass the final exam will result in a failing grade for the course.
- Homework will be assigned and collected, but it will not be corrected.
- Solutions will be posted after the due dates.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

https://web.uvic.ca/calendar2019-01/undergrad/info/regulations/grading.html

Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.

https://web.uvic.ca/calendar2019-01/undergrad/info/regulations/exams.html#

Note to students: Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Assistant to set up an appointment.

Accommodation of Religious Observance:

Policy on Inclusivity and Diversity:

Standards of Professional Behaviour: You are advised to read the Faculty of Engineering document Standards for Professional Behaviour, which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the entry in the current Undergraduate Calendar for the UVic policy on academic integrity.

Equality: This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Resource Centre for Students with a Disability located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

Course Lecture Notes: Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.